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ABSTRACT

Research suggests that intuitive parental didactics related to infants' production of vocal sounds, vocal imitation, and vocal play are a prerequisite of human language acquisition. Microanalyses of videorecords of parent-infant interactions have revealed intuitive forms of parental behaviors that parents carry out unknowingly and can hardly control consciously. A finer analysis of such intuitive parental behaviors has revealed that they fulfill criteria of didactic interventions, since parents enhance infant skills and intervene in accordance with the momentary state of infant alertness, attention, affective mood, and limits of tolerance. Several intuitive parental interventions support the establishment of visual contact with infants, a phenomenon that seems to be unique in the animal world where a direct eye-to-eye gaze commonly functions as a threat. Similarly, intuitive parental interventions support vocal imitation and vocal play in the human infant, and this support also seems to be specific to humans. Since parents teaching infants convey procedure-based rather than data-based information, it is possible that human infants can benefit from process-oriented parental interventions even though they may lose factual, data-based knowledge acquired during infancy. Repeatedly exposing infants to stimulation which activates integrative processes may result in more efficiently organized learning and cognition. (RH)

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THE STRUCTURE AND DYNAMICS OF EARLY PARENTAL INTERVENTIONS:
A POTENTIAL CONTRIBUTION TO EVOLUTION AND ONTOGENY OF SPEECH

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The acquisition of speech, both in ontogeny and phylogeny, has only recently attracted attention in developmental and comparative sciences, although cultural achievements, based upon verbal communication, have clearly attributed to speech the quality of a uniquely important, adaptive potential. However, anthropologists and comparative biologists have come to the conclusion (Lieberman, 1985) that the prerequisites of this unique adaptive potential are far from being unique in the animal world, and that speech has evolved in humans only as an advantageous combination of prerequisites that can be found not only in primates but also in other species, including some insects.

The prerequisites of speech include the evolution of an adequate vocal tract allowing a fine differentiation and a fast combination of vocal sounds, and the evolution of complex brain structures allowing an immediate perceptual processing of the immense amount of combinations in which speech sounds can be produced as well as the use of abstract symbolization in processes of thought. It is the complexity of the two matching capacities--the production of such variable utterances, and their use in symbolic thinking--not their fundamental forms, that have enabled humans to achieve unique levels of adaptation as exemplified in modern civilization and technology. Comparative studies have also elucidated that simple forms of learning, imitation, concept formation, or symbolic communication about environmental circumstances do not require as complex brain structures as those in an adult human brain but can function in organisms with much simpler nervous structures, such as the cranial ganglion in the honey-bee.

The Darwinian interpretation of factors influencing the evolution of speech has attributed the main role to the use of tools in humans. However, tool use is not unique to humans either, and moreover, the recent paleontological findings seem to require a substantial correction of Darwinian interpretations. Thus, Lovejoy (1981) suggested that bipedalism as an incidental, perhaps disadvantageous form of locomotion had preceded tool use in hominids and was selected during evolution due to its role in parental care for progeny in hominids during the Miocene age when a higher rate of reproduction and a shorter birth span had evolved in hominids as compared to other primates. Prosocial behaviors including a rather differentiated communication and social cooperation have been assigned a major significance in the evolution of speech and culture, according to Lovejoy.

The acquisition of speech during ontogeny should be easier to study than the evolution of speech, and yet, some of its aspects have remained unclear, such as the question concerning environmental support to speech acquisition. Two arguments are evident: (1) in cases of transcultural adoptions, children acquire the language of adoptive rather than biological parents; and (2) parents and caregivers seem to be unable to convey the rules of grammar and syntax to the progeny prior to the progeny's acquisition of speech. Some linguists have strongly recommended parents to use only correct forms of language in order to facilitate speech acquisition. In our present study, we have found that an increasing proportion of parents in the United States read books to very young infants nowadays in order to facilitate not only speech acquisition but also learning foreign languages in the future. Swiss parents are acknowledged breeders of polyglots, however, they have never applied the reading of books to preverbal infants as far as we know.

Traditions in the care for human infants have been studied rather extensively by various authors. For instance, Fritz Heider analyzed naive psychology, including parental beliefs on child rearing; Albrecht Peiper collected rich historical documentation on the care for infants; and recently Bell and Harper analyzed child effects on adults in historical perspectives. Nowhere, however, has there been an evident tradition reported in relation to the support of speech acquisition in infants during the preverbal age, according to our knowledge. Thus at the beginning of our studies, we were left with the impression that infants acquire speech due to maturation of the vocal tract, due to innate capacities of perceptual learning, imitation, abstraction and symbolization, and due to an innate set of rules that allow preverbal infants to grammatically and syntactically arrange the first words into meaningful entities.*

*Due to an error on the word processor, pages 2 and 3 are shortened.

However, even if we should have been ready to admit that innate programs per se could be sufficient prerequisites for the acquisition of speech during ontogeny we were still hesitant that innate programs would explain the whole story. Such a story would be very exceptional in biological terms since, in nature, the most significant means of adaptation are not only based on selected genetic programs but also meet ecological counterparts among environmental factors. Supportive environmental factors can often be found in certain surplus which, in general, simply increases the probability that the biologically significant means of adaptation will function effectively.

Our former interest in the early ontogeny of learning and cognitive infant capacities, and our search for everyday situations in which human infants might practice in those integrative capacities have drawn attention to those forms of parental behaviors which parents carry out unknowingly and can hardly control consciously, and which we have called intuitive or nonconscious. We discovered a set of very interesting behaviors which had escaped the previous attention of researchers, most probably due to the fact that intuitive behaviors cannot be studied with the help of mere questionnaires or traditional pencil-and-paper type of observational protocols. We only found those behaviors when we started using microanalyses of films or videorecords of parent-infant interactions in 1968 at Jerome Bruner's Center for Cognitive Studies.

As repeatedly reported since 1977, the set of intuitive parental behaviors provides young infants with a large amount of episodes -- often around 20 per minute during parent-infant interactions -- in which parents make themselves contingent, easily predictable, and manipulatable by the infant. From the very beginning (Papoušek and Papoušek, 1977), we have also reported that experimental interventions altering the contingency and predictability of those intuitive parental interventions easily upset the infant and lead to signs of unpleasure and frustration in the infant.

A finer analysis of intuitive parental behaviors has revealed that they fulfill criteria of didactic interventions since parents enhance infant skills and intervene in accordance with the momentary state of infant alertness, attention, affective mood, and limits of tolerance. We suggested (Papoušek and Papoušek, 1978) that there is a primary, biologically determined model of didactics included in intuitive parental behaviors, and that it mainly concerns the means of preverbal communication, namely, the preverbal vocal, facial, and gestural patterns of communication.

As M. Papoušek reported at the preceding ICIS meeting in New York (1984), our interpretation of parental interventions as didactic interventions is not

merely speculative. For instance, a statistical evaluation of the distribution of melodic contours in maternal speech to young infants in relation to various interactional contexts (see Tab. 2) showed that the contingency coefficient was lowest for associations with the type of sentences (0.385) and the infant's state (0.391), but increased from infant vocal expressions (0.461) in the direction of the focus of maternal attention (0.630) and reached a maximum in associations with maternal didactic intentions (0.711) which mothers frequently express in the lexical content of their baby talk.

In order to understand the significance of intuitive parental interventions, let us first consider some general qualities of intuitive behaviors, as they are listed in Table 1. Intuitive responses are more flexible than innate reflexes and thus allow a fine adjustment to environmental circumstances. They are slower than innate reflexes but still faster than conscious, rational decisions, they are less strenuous than rational responses, and thus they occupy less parental attention allowing the parent to stimulate the infant adequately and simultaneously to control other circumstances or ongoing activities.

Intuitive parental interventions may appear finely adjusted to each infant in individual cases, however, the underlying tendencies have been found to be universal across parental sex, age, and across at least some cultures. At the present conference, for instance, one of our posters has documented how qualitatively congruent are mothers and fathers in the use of melodic contours in the prosody of baby talk. The use of the baby talk is also a good example of universality of these interventions across age since children start displaying typical features of the baby talk around 2 to 3 years when addressing to young infants (Phillips, 1973; Papoušek and Papoušek, 1981). The universality of didactic interventions seems to cause a qualitative homogeneity, necessitated by the constraints of infant learning and cognitive capacities, whereas their quantity seems to be variable across social classes and cultures, and also to depend on the amount of experience in caregiving to infants (Papoušek, Papoušek, and Bornstein, 1985). For instance, traditionally fathers have been reported to talk less to babies than do mothers (Field, 1978; Pedersen, Anderson, and Cain, 1980), lower-class mothers to talk less than do middle-class mothers in the United States, in England, and in Israel (Field and Pawlby, 1980; Ninio, 1980; Tulkin and Kagan, 1972). Mothers also speak less to babies due to cultural beliefs, for instance, among Guatemalan Indians (Kagan and Klein, 1973) or among African Zambians (Goldberg, 1977).

The infant's visual attention is an important assumption for the acquisition of languages inasmuch as it enables the infant to imitate and learn oral and facial movements, involved in the production of speech sounds, or nonvocal signs, such as, for instance, in deaf families that use sign languages. Therefore, it is interesting that several intuitive parental interventions support the establishment of visual contact with infants. These interventions again are universal across sex and some cultures, as has been shown in the control of the distance between the parent's eyes and the infant's eyes, in the tendency to achieve face-to-face position (see examples in a Chinese mother in Fig. 1 and in a German father in Fig. 2 and 3), and in

rewarding the achievement of visual contact with a complex "greeting response" shown in Fig. 4 and 5. Recently, the "greeting response" in the achievement of eye-to-eye contact has been found to function in 3-month-old infants (Haekel, 1985) as shown in Fig. 6 to 9.

The control of visual attention for prosocial, didactic purposes in humans seems to be unique in the animal world where a direct eye-to-eye gaze commonly functions as a threat, eventually followed by aggressive behaviors. So far, we have not been able to find any examples of a prosocial support for visual contact in animal studies.

I myself have in vain looked for an analogy of human tendencies in mother-infant interactions in the lowland gorilla and in the pygmy chimpanzee, i.e., in primate species, most similar to humans. As the next slides show, humans regularly tend to gain the infant's visual attention, then to reduce the eye-to-eye distance to 20 to 25 cm, and to talk to the infant (Fig. 10 to 14). The gorilla mother most of the time carefully observes the environment, and when she visually checks the infant her visual contact is most frequently followed by grooming (Fig. 15 to 17). The same sequence is typical for the pygmy-chimpanzee mother (Fig. 18 to 20). Thus it is our belief that the human motivation for a direct eye-to-eye contact belongs to species specific forms of support for social communication.

Similarly, intuitive parental interventions support vocal imitation and vocal play in the human infant, and this support seems to be specific to humans as well. Only exceptionally, emissions of a highly variable stream of vocalization, similar to "babbling" or "vocal play" in human infants, have been reported by Snowdon (1982) in infant marmosets and cotton-top tamarins, separated from their parents. However, there is no evidence that monkey parents support infant babbling whereas human parents encourage and socially reward infant vocal play or vocal imitation. Both vocal play and vocal imitation in human parent-infant interactions represent complex problems in terms of definitions, measures, and interpretative concepts in spite of the significance for speech acquisition, attributed to them by Piaget (1952). For instance, parental vocalization may be imitated by infants, however, parents mostly use sounds that are already included in the infant's contemporary repertoire when encouraging imitation in infants. Thus it is difficult to decide who imitates whom. Moreover, the term "imitation" can hide very different adaptive tendencies which sooner or later during human life become more evident in social interactions and can then be differentiated not only as simple imitation but also as encouragements for repetitive practicing, or as repetitions serving for didactic displays of desired models, or as duetting and sharing of emotions, or as precursors of social coactions.

Thus far, we have cautiously been speaking of vocal matching and we have been differentiating only parent-infant or infant-parent sequences in our first analyses of parent-infant vocal interchanges, as evident in Fig. 21 and 22. As explained in one of our posters at the present conference, these Figures illustrate the frequency of matching at various early ages, and the involvement of individual speech sounds in matching.

The time limit does not allow us to give more examples or more details concerning intuitive parental interventions during the infant's preverbal life. Interestingly, parents do not attempt to attribute any semantic meaning to infant vocal sounds before the first repetitive syllables appear in the infant's repertoire. It means that parents only teach the infant how to produce and modify sounds or signs; or expressed in other words, parents convey procedure-based but not data-based information. This is necessary to keep in mind with respect to the potential objection that didactic interventions during the preverbal age are useless due to infantile amnesia, documented primarily in animal studies.

Recent evidence, reported by Cohen and Squire (1980) indicates that in humans the two types of information, namely data-based versus procedure-based types, are stored in memory differentially, the latter being much more resistant to amnesia. Therefore, the possibility cannot be excluded that human infants can benefit from process-oriented parental interventions even though they may lose factual, data-based knowledge, acquired during infancy. Our former studies on infant learning (Papoušek, 1967; 1977) offer perhaps the only evidence suggesting that repeatedly exposing the infant to stimulation which activates the integrative processes may result in more efficiently organized learning and cognition. Thus the primary long-range benefit from early didactic support might be precisely such procedural improvements, i.e., the action-based "learning how to learn".

In conclusion, I should like to recapitulate the present interpretation of the prerequisites of human languages (see Tab. 3) and stress our belief that next to the two types of prerequisites mentioned in my introduction -- the production of variable utterances due to morphology of the vocal tract, and their use in symbolic thinking due to the complexity of the human brain -- a third type has become evident in the surveyed research. This third type represents the intuitive parental didactics concerning the infant's production of vocal sounds, vocal imitation, and vocal play. We can only speculate on its significance for the evolution of speech. However, there is some evidence on its significance for speech acquisition during ontogeny. Bornstein and Ruddy (1984), utilizing a natural manipulation of maternal didactics in twins, elegantly demonstrated that twins obtain less than a half of maternal didactic interventions as compared to singletons, observed at 4 months. These deficits caused smaller speaking vocabularies and moderately lower Bayley Scale scores in twins than in singletons at one year.

Much more research is certainly necessary to elucidate at least the most interesting aspects of intuitive parental interventions. It is our hope that this presentation will help to attract more attention to them in the future infancy research.